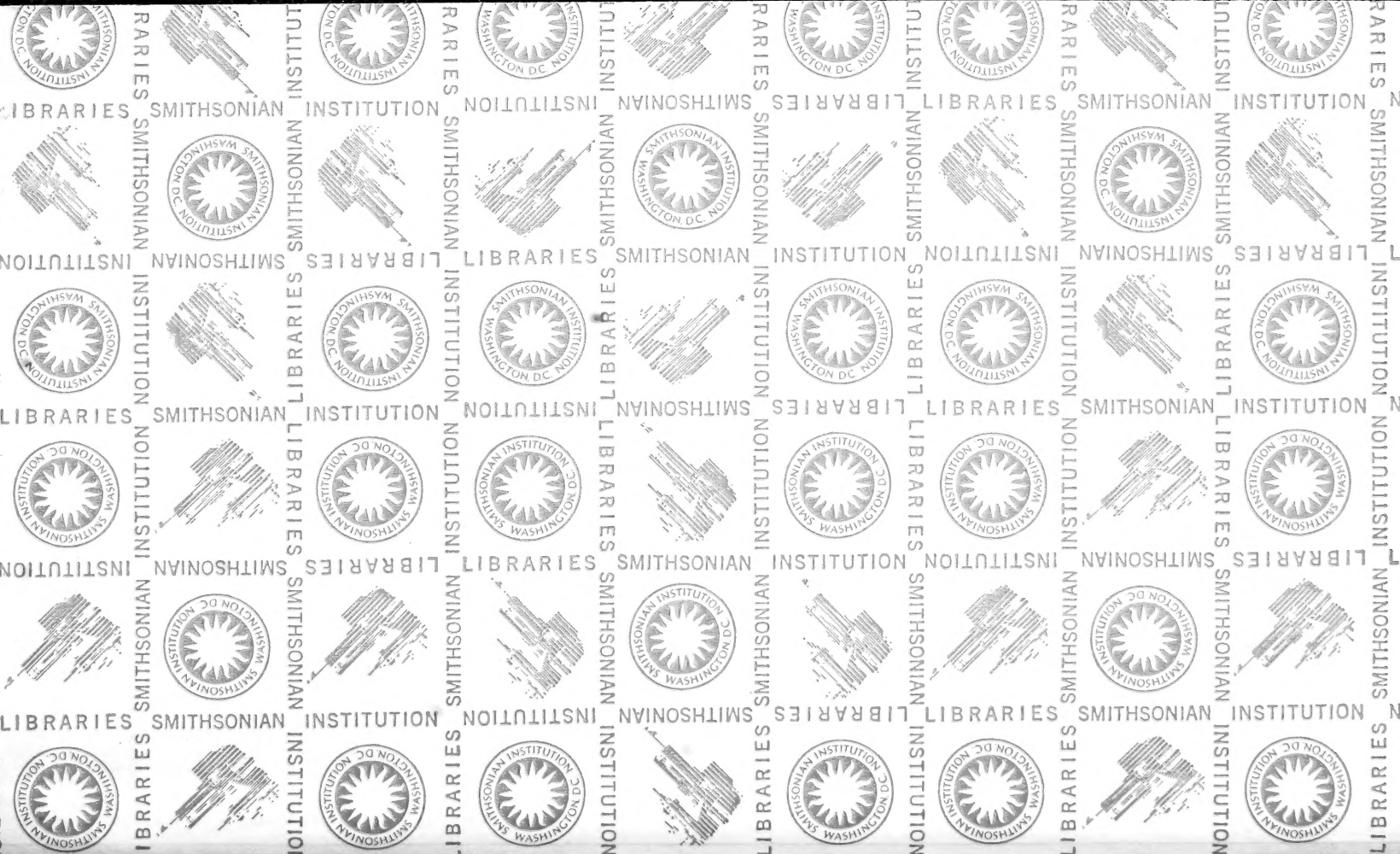
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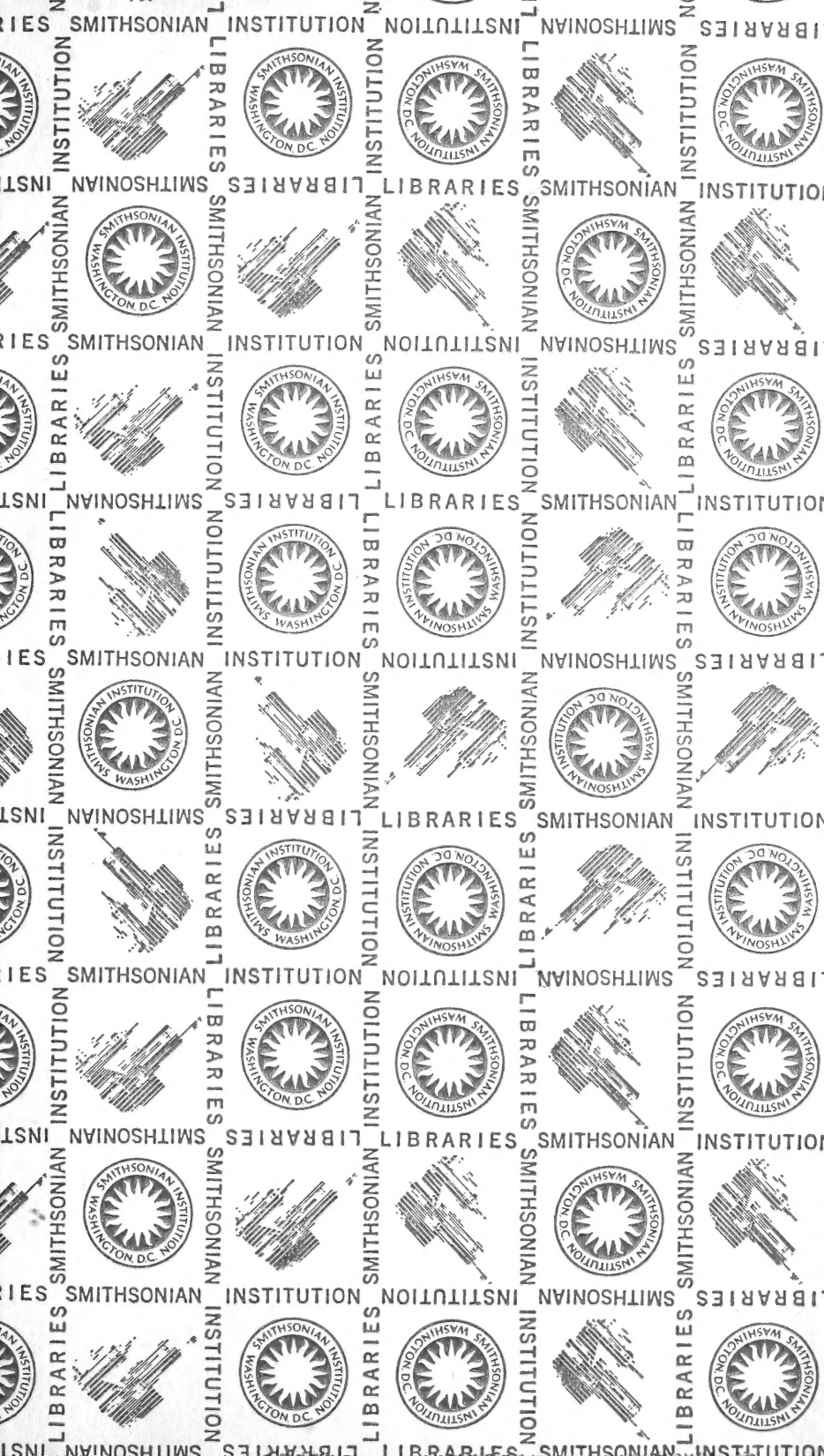
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New York State Museum

JOHN M. CLARKE Director

Bulletin 82

PALEONTOLOGY 12

GEOLOGIC MAP

OF THE

TULLY QUADRANGLE

BY

JOHN M. CLARKE *State Geologist and Paleontologist*

AND

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ALBANY

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Bulletin 82
PALEONTOLOGY 12

GEOLOGIC MAP
OF THE
TULLY QUADRANGLE

The formations represented in this very interesting area extend from near the top of the Siluric continuously upward into the Upper Devonic. The region is one of many fine exposures and though the topography has been in some measure modified by the accumulations of the soil cap, yet here are many typical and classical outcrops of the New York formations. It is moreover within easy reach of Syracuse and on this account it is believed the map will be found specially useful to the many students of geology in that city and scattered elsewhere over the neighboring country.

The units of sedimentation here described may be grouped as follows:

Neodevonic	Senecan	Ithaca		Ithaca flags and sandstones
		Portage		Sherburne flags
		Genesee		Genesee shale
		Tully		Tully limestone
Mesodevonic	Erian	Hamilton	Moscow shale	
			Ludlowville shale	
			Skaneateles shale	
		Marcellus	Cardiff shale	
			Marcellus shale	
	Ulsterian	Onondaga		Onondaga limestone
Paleo-devonic	Oriskanian	Oriskany		Oriskany quartzite
	Helderbergian	Helderberg	New Scotland limestone	
			Coeymans limestone	
Ontaric or Siluric	Cayugan	Manlius	Manlius limestone	
			Rondout dolomite	
			Cobleskill dolomite	
		Salina	Bertie dolomite	
			Camillus shale	

SILURIC

Camillus shale

This term has been applied to the gypseous shales lying above the horizon of the salt and forming one of the stratigraphic integers of the Salina group. It is the lowest formation represented on the map and only the upper portion of the shales to a thickness of about 40 feet is here exposed. The rock is a soft, dark gray shale containing a varying proportion of gypsum, usually in thin uneven seams or lenses. It is abundantly exposed and has been extensively quarried in the towns of Camillus, Elbridge and DeWitt in Onondaga county, Springport in Cayuga county and Phelps in Ontario county and is commonly known as "plaster rock." Though it is present in this area it has been excavated by erosion and then covered so deeply by alluvial accumulations through the Onondaga valley that at no place are the shales well displayed, and the estimate of its thickness as given is based on data derived from adjoining regions. Farther north in the town of DeWitt outside the boundary of this map, this rock is much thicker and at about 100 feet below the top of these shales, near the Heard quarries, there are some layers of limestone which contain in considerable abundance the species Leperditia scalaris Jones.

Bertie dolomite

This division of the Salina group, taking its name from its exposures in the township of Bertie, Ontario, is here composed of fine dark gray waterlime weathering to light drab, with a brownish or yellowish shade. At the base of the entire exposure which so far as exposed and calculated, is about 15 feet thick, 11 feet are thinly laminated. The upper stratum, 4 feet thick, is harder and but slightly schistose. In the western part of the State the rock becomes more compact and from it is quarried the very large amount of waterlime cement manufactured at Akron and Buffalo. It is not however used for that purpose in this vicinity, the heavier layers of cement rock higher in the section being preferred. Exposures of this formation are to be found along Butternut creek below Jamesville and this is the only place where the rock appears to advantage

on this quadrangle. At the Heard gypsum quarries in DeWitt, north of the quadrangle boundary, they may be seen overlying the Camillus shale and also in the abandoned Sweet quarry, 2 miles west of Marcellus station. The horizon is characterized by the presence in places of a great abundance of the crustaceans, Eurypterus, Pterygotus, Eusarcus etc. These singular creatures which appear to have attained the culmination of their development at this period in the geologic history of New York are not found here so frequently as at certain well defined localities to the east and west of this area, namely at Jerusalem hill, Herkimer co. Union Springs, Cayuga co. and Buffalo. Besides the remains of the Eurypterids there is an abundance of Leperditia scalaris Jones, a small Loxonema and Lingula sp. but these fossils all appear to be of rare occurrence.

Cobleskill dolomite

Next in order comes a very hard, rather fine grained dark gray limestone, here little altered by weathering, but farther west in the State where it is commonly known as the "bullhead" and is less pure, its color changes to a yellowish brown and it has a somewhat mottled appearance. The shearing marks known as *Stylolites* and small accretions of selenite and calcite crystals are common throughout the mass. In some localities this formation is quite fossiliferous, 60 species having been reported by Hartnagel from Schoharie county, 30 from the dark limestone of Frontenac island in Cayuga lake and 13 in the "bullhead" of Erie county. The low level of the country over the northern part of this map affords no favorable outcrops of this formation though it is unquestionably present as indicated by the contour of the topography and probably attains a thickness of about 6 feet. It appears however on Butternut creek below Jamesville and is exposed at the top of the section at the Heard gypsum quarry at DeWitt and at Browns falls on the west branch of Limestone creek, 1½ miles southwest of Manlius. The rock contains some fossils and the characteristic species are Spirifer crispus var. corallinensis Grabau, Whitfieldella nucleolata Hall, Chonetes jerseyensis Weller and Stropheodonta bipartita Hall.

Rondout waterlime

The preceding formation begins the series which represents the Manlius group. The deposition of waterlimes continues and the Rondout division is composed of a thickness of about 40 feet of hard, dark, blue gray dolomitic limestone weathering to a light drab, in layers of from 6 inches to 2 feet in thickness, some of which, in the upper part, are highly straticulate in appearance on account of thin seams of waterlime at intervals of ¼ to 1 inch. In some near-by exposures the lower part is more or less brecciated and contains many irregular cavities of which a large proportion was caused by the dissolution of the little coral Cyathophyllum hydraulicum Simpson. These beds are exposed but slightly in this quadrangle in the vicinity of the Dunlop limekiln, 1¼ miles north of Jamesville; in the bottom of the cliff at White lake, 1½ miles northeast of Jamesville and in a deep ravine in the northeast corner of this quadrangle. It is more favorably exposed in many places in the vicinity of Manlius. The fossils Cyathophyllum hydraulicum Simpson and Leperditia alta, together with Spirifer vanuxemi are common and characteristic of the horizon.

Manlius limestone

Very dark blue black, when fresh weathering to a light bluish gray, and after long exposure having a straticulate appearance produced by thin seams of impure limestone or waterlime at intervals of ¼ to 2 inches or more. This rock attains a total thickness of not less than 74 feet and occurs mostly in even layers from 6 inches to 2 feet in thickness, which split easily along lines of deposition, and some layers have a smooth cross or "diamond" fracture. It is very hard but rather brittle. At the top this formation includes two layers of impure dolomitic limestone extensively quarried in this vicinity for cement. At Jamesville the lower layer is 4 feet, 6 inches thick and increases slightly toward the west, while the upper is 3 feet, 6 inches thick and decreases in that direction. These are separated by 2 feet, 11 inches of dark laminated "diamond rock," the quarryman's term for the rock above described. The cement rock is lighter colored and more compact, showing but faint lines

of deposition and breaking with a conchoidal fracture. These beds are seen, in the lower part, along the road leading south from Jamesville to the reservoir on the west side of Butternut creek and in the cement beds in the Alvord quarries opposite the north end of the reservoir on both sides; also along the west side of Onondaga valley in the rear of the cemetery north of Dorwin's Springs, at several outcrops on the east side north of the reservation quarry, in the cliffs at the Jamesville, Green lake and the White lakes and in the ravines in the northeast corner of the quadrangle. In some of the blue layers fossils are quite abundant and of these Leperditia alta, Spirifer vanuxemi, Stropheodonta varistriata are most common. There are also many large masses of Stromatopora and Orthothetes interstriatus, Whitfieldella laevis, W. sulcata, Holopea antiqua and Tentaculites gyracanthus also occur in this horizon. The two cement layers are nearly barren throughout this region. Eurypterus remipes has been found at Split Rock and at Manlius but has not been reported from this quadrangle.

DEVONIC

Helderbergian limestone

Between the top of the Manlius and the Oriskany sandstone is a mass of limestone beds varying somewhat in appearance and attaining a total thickness of about 40 feet. These are very dark blue gray rocks weathering light bluish or ashen, in layers from 1 to 10 feet in thickness, some of these layers being laminated and splitting readily along lines of deposition. Others are more compact and have no regular fracture, being composed largely of masses of Stromatopora and Favosites. These rocks were referred to the Helderbergian limestones though it is not at present easy to correlate them closely with the subdivisions of that series as developed in the region of typical outcrops in eastern New York. The statement, however, may be safely ventured that they are the westernmost representatives of the lower deposits of that series, viz the Coeymans limestone and the New Scotland limestone.

These beds are exposed in the Alvord quarries northwest of the Jamesville reservoir, on both sides of the valley; also in the cliffs at

the Green lake, 1½ miles west and the White lake, 2 miles northeast from Jamesville. They are also seen in the Onondaga valley in the old quarry east of the cemetery, ½ mile north of Dorwin's Springs and in several other quarries and ledges on both sides between the north line of the quadrangle and the reservation quarry. The rock thins out and disappears at Split Rock near the northwest corner of this quadrangle but reappears farther west and is 17 feet, 9 inches thick in the Corrigan quarry on the Skaneateles outlet.

Fossils abound, specially Stromatopora, Favosites and Leperditia; Spirifer cyclopterus, Leptocoelia, Leptostrophia becki, Leptaena rhomboidalis, Meristella laevis, Rhynchospira formosa, Tentaculites elongatus and a few other species have also been recognized and these occur most abundantly in the upper part of the strata.

Oriskany quartzite

This formation is very variable in thickness, sometimes not more than 4 inches and sometimes 6 to 7 feet. It is a light gray occasionally pinkish granular quartzite. The basal part which is nodular for a few inches, usually contains flattish fragments of dark hydraulic limestone. In some of the localities the sand grains are well cemented and the rock durable, at others it is friable and weathers to a dark rusty brown. In the northeastern corner of this area it composes the lower part of the layer 2 feet 3 inches thick, the upper part of which is limestone into which the transition is very gradual. Near Jamesville it is 3 feet, 6 inches thick, dark colored and friable and on the west side of the Onondaga valley opposite Onondaga Castle, it is 5 or more feet thick, light colored and quite durable.

The rock is exposed in the ravines and north of the highway to Manlius, 4 miles east of Jamesville, in the cliffs at the White lakes and the Green lake, in the Alvord quarry south of Jamesville, in the highway near the Reservation quarry and in ledges northward on the east side to the Jamesville road. On the west side opposite Onondaga Castle it is shown in a prominent ledge near the highway and extends for about ½ mile, the rock here being a clean sandstone. Many loose blocks are scattered along the side of the valley north-

ward. In the Solvay salt wells in Tully valley the Oriskany sandstone was found to be 15 to 18 feet thick and it is 18 feet thick at the Corrigan quarry on the Skaneateles outlet. East and west of this area the rock thickens and thins, sometimes entirely disappearing from the succession as at Split Rock quarry where it appears at one end of the quarry and is absent at the other. This succession of lentils begins in the eastern part of the State and gradually disappears westward and from Ontario county to Lake Erie it is simply a thin continuous mantle of sand, sometimes quartzitic, which has evidently been washed from a shelving and eroded shore extending as far as Buffalo.

The fossils of this rock are those found more abundantly in the better development of the sandstone as at Oriskany Falls and Yawgers woods, Union Springs. Spirifer arenosus is common as well as Leptaena ventricosa, Hipparionyx proximus, Meristella lata and a few other forms. Rensselaeria ovoides, one of the index fossils of the horizon, is rare in this vicinity.

Onondaga limestone

This important limestone formation attains a thickness of 65 to 70 feet, increasing slightly from east to west. It is a series of light bluish gray, glistening, semicrystalline limestone strata in even continuous layers from 1 inch to 2 feet, 6 inches in thickness, separated by thin seams of dark calcareous shales. Many of these layers are highly pure limestones but others not confined to any particular horizon are shaly and more or less impure. Flattened nodules of dark blue or black chert, sometimes in continuous sheets, occur unevenly distributed throughout the entire mass, though most common in the upper part. In the region west of the area under consideration the lower beds of this limestone are usually comparatively free of chert and are highly abundant in corals, these corals having formed very extensive reefs along the shore of the ancient continent, but this is a characteristic not continuous throughout the sections of the formation in the State and from here eastward the lower layers contain considerable amounts of chert, rather uniformly distributed through the entire mass of the limestones. Formerly the

term Onondaga limestone was applied to the lower and purer layers and the name Corniferous limestone attached to the chert-bearing upper deposits, but this distinction, while an important one locally, has given way to the application of the term Onondaga to the entire formation.

Outcrops of the Onondaga limestone are frequent in the vicinity of the road leading from Jamesville to Manlius. A large quarry on the east side of the Jamesville reservoir is in this rock and there are large exposures of it along the creek above the Alvord quarry south of Jamesville; also on the road from Jamesville to East Onondaga and along the east side of the Onondaga valley in the Reservation and other quarries. Near the highway south of Indian Village and along the west branch of Onondaga creek to 3 miles northwest of South Onondaga it is also well seen.

Fossils are everywhere abundant but not always easy to extract. The species which the observer may expect to find are those of the formation generally and therefore the student is referred to such lists of these fossils and detailed descriptions of them as have been given in other publications on this subject. The most common however are the following: Atrypa reticularis, Leptaena rhomboidalis, Stropheodonta concava, S. inaequistriata, Spirifer acuminatus, S. divaricatus, and some other brachiopods; the cephalopods Cyrtoceras undulatum, Gyroceras trivolve; the trilobites Odontocephalus selenurus and Phacops cristata var. pipa; large crinoid columns are also common at some horizons.

Marcellus shale

Including the Agoniatites limestone

The term Marcellus shale has been generally applied heretofore to the entire series of black, blue black and blue gray shales lying above the Onondaga limestone and the presumptive base of the Hamilton series of shales and limestones. The distinction between this formation and the shale formation of the Hamilton has always been a matter of pure convention as one mass passes into the other with very gradual change in color and equally gradual change in

the fauna. On behalf of a more exact basis for correlation we have already proposed to restrict the term Marcellus shale to that part of the series best exposed in the hill at Marcellus village.[1] This is the lower portion of the mass and is well defined. At the base the rock is a dark gray, somewhat calcareous and bituminous shale with very thin layers of impure limestone. It gradually becomes less calcareous and a deeper black for a distance of 13 feet. Here appears a stratum of hard bituminous limestone 2 feet and 6 inches in thickness and this has been generally known as the Goniatite limestone but which for precision of expression is better termed the *Agoniatites limestone* on account of the prevalence of the species Agoniatites expanus Vanuxem. This layer is a lentil in the Marcellus shales though one of wide extent. Both below and above the Agoniatites limestone the shales are densely black and bituminous to the top of the formation. In the upper layers are occasional thin leaves of limestone and also rows of symmetrical subspherical concretions from a few inches to 2 feet in diameter. At the top this shale mass gradually becomes more argillaceous and lighter colored and on the map the line of separation from the succeeding formation indicates the horizon at which the black shale no longer constitutes the larger proportion of the rock. The thickness of the entire mass is 100 feet.

These Marcellus shales are not well exposed in their entirety anywhere on this quadrangle though a small ravine on the west side of Onondaga Valley 1 mile south of the north line of the map shows the base of the section at 760 feet A. T.; also the Agoniatites limestone and a part of the upper black shales above. The limestone outcrops in the Manlius road 2 miles east of Jamesville and the black shales on the east slope of the same hill. There is a small outcrop of the limestone on the brook that crosses this road at the next four corners about 20 rods above the road. The limestone forms the crest of a small cascade 40 rods south of the Manlius road in Gifford's glen, a small ravine near the schoolhouse of district no. 8, in the southwest corner of the town of Manlius, and 3/8 mile within the east line of this quadrangle. The limestone here is in three

[1] N. Y. State Mus. Bul. 63. p.14.

layers, the lower one 1 foot, the second 1 foot, 2 inches and the upper 6 inches thick and is exposed for a short distance in the sides of the ravine, where it contains the interesting fauna of the stratum in excellent preservation. It is again seen on the highway on the west branch of Onondaga creek near the west line of the quadrangle, together with a small exposure of black shale. The lower black shales are exposed just above the forks of the creek 1 mile southeast from Indian Village, and the upper part of the formation in the highway and cliff on the east side of Onondaga creek near the south line of the Indian Reservation.

This Agoniatites limestone can not be traced very far to the east but westward it is continuous to Union Springs, Cayuga co. and Phelps, Ontario co., where it loses its individuality. In the black shales fossils are rare except at the base of the formation where Liorhynchus limitaris is very abundant and sometimes produces calcareous lenses. With it are associated Orbiculoidea minuta, Chonetes mucronatus, Actinopteria muricata, Pterochaenia fragilis, Styliolina fissurella, Orthoceras subulatum and a few other species, all of which are of tenuous shell and rather diminutive size, indicating the deterrent effect on growth of the conditions in which the fauna was involved. Occasional remains representing the arthrodirous fishes have been found.

The Agoniatites limestone is more prolific in species which are in large part peculiar to it and are often finely preserved, specially important and significant here being the assemblage of cephalopods. The species which one may expect from this rock are as follows:

Mesothyra?
Proetus haldemanni *Hall*
Cyrtoceras alternatum *Hall*
C. liratum *Conrad*
Gomphoceras conradi *Hall*
G. fischeri *Hall*
G. oviforme *Hall*
G. solidum *Hall*
Nephriticeras bucinum *Hall*
Nautilus liratus *Hall*
Discites marcellensis *Vanuxem*
Parodiceras discoideum *Conrad*
Agoniatites expansus *Vanuxem*
Thoracoceras wilsoni *Clarke*
Orthoceras aptum *Hall*
O. marcellense *Vanuxem*
O. constrictum *Conrad*
Euomphalus planodiscus *Hall*
Loxonema delphicola *Hall*
Macrochilina onondagensis *Clarke*
Lunulicardium curtum *Hall*
Panenka ventricosa *Hall*
Liorhynchus limitaris *Hall*

Cardiff shale

This name has been applied to the upper beds commonly embraced under the unrestricted term Marcellus shales. These are for the most part blue gray shales at the base, being soft and argillaceous with frequent layers of darker shale. Ascending, the mass becomes lighter in color and near the top are some layers which, on exposure, become very light gray and the darker layers are thin and less frequent. Toward the top are occasional thin calcareous layers and small concretions. This division maintains its general character to the east and also westward but in the latter direction becomes thinner. The thickness of this mass is about 175 feet.

Exposures are found in two ravines on the east side of Onondaga valley, 1⅛ and 1½ miles north of Cardiff, at the salt well 1 mile south of Cardiff, at the mouth of the Bear mountain ravine 2½ miles southwest and also along the dugway road leading to Maple Grove 3 miles northwest; likewise in the ravine 1 mile south of South Onondaga; 1 mile southeast from Indian Village; 1½ and 2 miles southeast from Jamesville. The contact with the succeeding division is best shown near the mouth of Bear mountain ravine.

The fossils of this rock are of infrequent occurrence and poor in preservation. Toward the top are found impressions of Parodiceras discoideum, Bactrites and Orthoceras and some thin layers contain Strophalosia truncata with Liorhynchus limitaris and L. multicostata in large numbers. L. limitaris is by far the most abundant species here as it is of the darker shales below and the horizon at which it ceases to be common and where new forms not seen below appear, is taken as the upper limit of the formation.

Skaneateles shale

The term *Hamilton group* as it has been employed in the New York nomenclature has been subject to misuse. The term was originally used by Vanuxem in the form "Hamilton group" to describe certain beds of sandy and argillaceous shales typically exposed at West Hamilton, Madison co. Strictly speaking, the only proper application of the term is to these beds and their stratigraphic equiva-

lent. Subsequently the formations, which were termed by Vanuxem and Hall Skaneateles shale, Olive shale, Ludlowville shale, Encrinal limestone and Moscow shale, were grouped together under the name Hamilton group and by James D. Dana Hamilton group was made to include the Marcellus shale, Hamilton shale and Tully limestone. We now find ourselves compelled to fall back on the original nomenclature of the units, and the term Skaneateles shale is here applied to that bed of strata for which the name was originally used by Vanuxem. These rocks have a thickness of 335 feet in this quadrangle, decreasing toward the west. They are at the base for 20 feet soft blue shales in which fossils are much more abundant than in beds of somewhat similar aspect constituting the Cardiff shale below. In the Onondaga valley these are overlain by a compact blue limestone about 1 foot thick which, in the Bear mountain and other ravines, produces a cascade. Above these limestones the shales are sometimes light bluish gray but mostly quite dark and very soft. Small concretions are abundant in the lower part of the beds both above and below the limestone. Near the top of the shales there are occasional thin lentils of limestone composed of masses of fossils.

The most favorable exposure of these beds is that in the Bear mountain ravine 1 mile west of Tully Valley where the entire section of this division is exposed. Others in the Onondaga valley are in the ravine at Tully Valley; that east of Cardiff; that 1 mile south of South Onondaga and the Joshua ravine 1 mile farther west. In the Butternut creek valley along the Delaware, Lackawanna & Western Railroad in the vicinity of Onativia and northward and also in the lower part of the Conklin's falls ravine and several others on the east side of the valley to the Jamesville-Pompey Hill road, there are additional outcrops; and the shales are also to be seen on the north slope of Pompey hill, 2½ to 5 miles southeast of Jamesville.

The shales at the base of the formation and the limestone contain many brachiopods, specially Spirifer, Productella and Liorhynchus and some cyathophylloid corals. In the upper soft shales the brachiopods, lamellibranchs, Pleurotomarias, goniatites, trilobites and crinoids characteristic of the Hamilton fauna are distributed unevenly throughout the beds but nowhere in large numbers.

Ludlowville shale

A large part of this division consists of beds of sandy olive shale and laminated sandstones which appear on the sides of the Onondaga valley south of Cardiff as escarpments or terraces. There are alternations of soft dark shales like the Skaneateles beds but the sedimentation taken as a whole is much coarser than in that division or in the horizon of the typical Ludlowville shales on Cayuga lake and westward. The thickness of the mass is 350 feet at its maximum, thinning toward the west. The upper limit is marked by an uneven layer of hard bluish encrinal limestone at some exposures quite compact and about 1 foot thick but at others in the eastern part of the quadrangle concretionary or coarsely nodular. It is continuous toward the west, appearing in the cliffs along Cayuga lake south of Aurora and in Ontario county. The entire section is exposed in the Fellows falls ravine but is not accessible except at times of low water. There are many escarpments, ledges, field outcrops and ravines on both sides of the Onondaga valley south of Cardiff that afford favorable exposures of all parts of the formation. There are extensive outcrops ¾ mile northeast of the village of Lafayette, and 2 miles north and northeast of the village of Pompey; also along the highway on the hillside 1½ miles northeast of Apulia station; and the terminal limestone with the underlying shales may be seen in the bed of the small stream that crosses, 1 mile from the corner, the road leading north from the Apulia-Fabius highway 3 miles east of Apulia station. This limestone is also seen in the road leading north on the east side of Kingsley hill; 1¼ miles west of Maple Grove, in the town of Otisco. The sandy layers are exposed at the mouth of Bucktail ravine at Spafford valley and in an escarpment on the east side of the Otisco valley.

These rocks are the most profusely fossiliferous of any in the quadrangle and some of their localities and specially the exposure in the ravine at Pratts falls just to the east of the quadrangle, have furnished extensive collections for many years, for paleontologic study. The series of species is not an extensive one but the predominating forms are the lamellibranchs and brachiopods. Beds of cyathophylloid or so called *staghorn* corals are found in it, an ex-

tensive one being exposed in the Fellows falls ravine 3 miles west of Tully. Here also occurs with some frequency the large trilobite Homalonotus dekayi which is very rare in more westerly outcrops but even more abundant in Madison county. The composition of the fauna as a whole is interesting in the extreme and no more favorable collecting ground could be indicated to the student of fossils than the several outcrops of this formation.

Moscow shale

In western New York there lies between the Ludlowville and Moscow shales a limestone which has usually been termed the Encrinal limestone though it is now recognized that this name was applied by the early geologists and has been since, to limestones lying at different horizons. This dividing limestone is now known as the Tichenor and if there is any representative of it so far to the east as this, it may be the summit layer we have just considered under the foregoing caption. The Moscow shales are a soft dark gray argillaceous mass that weather to a much lighter shade and attain a thickness of 180 feet. There is but little lime carbonate in the rocks, represented by occasional irregular concretions and thin calcareous lenses. The formation as a whole is somewhat darker and less calcareous and also less fossiliferous than in its extent westward. The upper limit of the formation is the base of the Tully limestone.

These rocks are seen in the Bucktail ravine at Spafford valley and in the ravines and field outcrops on the east side of the Otisco valley; along the highway at the foot of the escarpment on the Tully road, 1½ miles southeast of Vesper; along the dugway road leading north from Tully Center; in a ravine 1 mile northeast of Tully; along the highway and hillside 1½ miles north from Tully station; along the creek and on the hillside 3 miles north of Apulia station and at Tinkers falls in the town of Truxton.

Fossils are on the whole not very abundant in the shales but the concretions and calcareous lenses contain many brachiopods and small lamellibranchs. While the fauna is a varied and comprehensive one it is less profuse and less well preserved than that of the Ludlowville shales, from which it differs only in minor respects.

Tully limestone

This is the typical region of this interesting formation, and here it attains almost its maximum thickness. The formation which is a very important bench mark in the Devonic series extends from here westward to within ½ mile of the eastern shore of Canandaigua lake, Ontario co. and from here eastward almost to the village of Smyrna, Chenango co. The formation is regarded as constituting the basal element in the New York Upper Devonic, for though its species are largely those of the fauna beneath yet there are new appearances which give to it the distinctive stamp of later age. On this quadrangle the formation in Carr's quarry, 2½ miles west of Tully is 23 feet, 4 inches thick, in 10 layers, varying from 1 foot, 3 inches to 3 feet, 9 inches in thickness. The principal part of the rock is fine grained blue black limestone that weathers light gray, very hard when fresh but after long exposure inclined to crumble into a mass of small angular fragments. The basal layer and others higher in the section are shaly to a greater or less degree. In its more western exposures the limestone is purer and the layers thicker.

The best exposures afforded on this quadrangle are in the Bucktail ravine above Spafford valley and 1½ miles east on the east side of the Otisco valley; also in the highway over Kingsley hill, 1½ miles west of Maple Grove and on Bear mountain ¾ mile southeast of Maple Grove. This limestone is seen in the ravine 1 mile southeast of Vesper and in the escarpment near the highway from that point for 1½ miles, including Carr's quarry. It is exposed in the highway leading east up the hill on the south side of the ravine on the east side of the valley 3½ miles south of Tully; also in the highway and in Ousby's quarry 1 mile southeast of Tully; in the ravine 1 mile northeast of Tully; at Tinkers falls; in the highway on the north side of Shackham brook and 3 miles farther north in the same valley; near the top of the hill 1 mile southeast from Berwyn and at the top of the hill 1½ miles from that point toward the southeast; and there are several small exposures along the northern face of South mountain and the hill east of Tully.

The characteristic fossils of the fauna of this limestone are the trilobite Bronteus tullius and the brachiopods Hypothyris cuboides and Schizophoria tulliensis, all of which serve to indicate definite progress in time over the immediately preceding fauna. As before stated the other species of the fauna are essentially those of the shales beneath and amongst them Spirifer tullius, S. subumbona, Atrypa spinosa, Camarotoechia congregata, Chonetes aurora and other brachiopods occur, and together with them masses of cyathophylloid corals and some large orthoceratites.

Genesee shale

In the original section of these rocks on the Genesee river it has been found important to divide the formation, restricting the term Genesee to the more densely bituminous beds at the base. This is a subdivision which applies wherever the formation is well developed and hence throughout the region of western New York. To the upper division we have given the name West River shale. In Onondaga county however and eastward to the disappearance of these beds in Chenango county no such subdivision seems practicable at present. Hence we include under the term Genesee shale all these dark or black bituminous slaty shales appearing at this horizon through a thickness of 75 feet. In the upper part there are thin bands of gray shales becoming more frequent and thicker toward the top and these give the beds a noticeable banded structure. The horizon at which the sandy beds begin to predominate is taken as the upper limit of the formation.

The Genesee shale is seen in exposures above the cascade in the Bucktail ravine and in a general way wherever the upper surface of the Tully limestone is presented. It is also exposed in the upper part of the ravine 1 mile east of Vesper; in that 3 miles west of Tully; south of Carr's quarry; in the Ousby ravine 1 mile southeast of Tully; above the cascade in Tinkers falls ravine and there are several slighter outcrops in ravines on the north slope of South mountain.

In respect to fossil remains the formation is extremely barren. Plant remains are not uncommon in the black shales and occasional fish plates are also found here, but though in its westward extent the rock carries a number of species of lamellibranchs, brachiopods and cephalopods, these are apparently for the most part absent here.

Sherburne flags

This term was introduced by Vanuxem in 1840 for the arenaceous deposits next succeeding the Black or Genesee shale. On this quadrangle the division attains a thickness of 210 feet and at the bottom consists of soft gray shales with thin layers of interstratified dark shale and thin flags. An uneven layer of bluish sandstone 1 to 2 feet thick occurs 25 feet above the top of the Genesee and is overlain by 6 to 8 feet of sandstone layers separated by gray shale; a bed 8 feet thick of gray and olive shale next above is overlain by a compact 12 inch sandstone. The remainder of the formation is composed of hard gray shales and thin sandstones, the latter becoming more frequent and heavier toward the top. These rocks are exposed in their lower part at the falls in the ravine 1 mile southeast of Vesper and the upper beds are exposed in the upper part of the ravine 1 mile south of Carr's quarry west of Mud lake. The rocks are also seen along the road leading east on the south side of the large gully 3 miles south of Tully and in the ravine and by the roadside east of Ousby's old quarry and in King's gulf ½ mile south of Ousby's. Also in an old quarry on the west side near the head of Shackham brook and in many outcrops along the north slope of Labrador hill and South mountain.

Fossils are of very rare occurrence in this formation. In a thick layer of sandstone, 115 feet above the base and exposed in King's gulf, was found a mass of Cladochonus and a few specimens of Spirifer mesacostalis, Buchiola speciosa, Tornoceras uniangulare, fragments resembling Manticoceras pattersoni, together with Palaeoneilo and crinoid stems. Spirophyton and some plant remains have also been found and some of these species indicate the feeble extension of the Intumescens or Naples fauna eastward. The Sherburne flagstones

are stratigraphically in the position of the beds of western New York (Cashaqua shale) which carry the peculiar Intumescens fauna in its highest development and to the exclusion of the brachiopod fauna of central New York.

Ithaca flags and sandstone

Next in succession and at the top of the rock series in this area are blue gray or olive shales, flags and sandstones, the latter sometimes being highly calcareous owing to the mass of fossils they contain.

These rocks constitute the upper portions of the high hills in the southern part of the quadrangle for a thickness of 450 feet and exposures of them are hence to be sought in this elevated country. They may be seen in the south branch of the small gully that leads west near the north end of Song lake and also along the highway on the south side of the ravine 3 miles south of Tully and 1 mile east of the foot of the hill; also along the road over the hill, 2 miles southeast of Tully.

The formation contains fossils scattered through thin layers usually separated by masses of barren measures. Species have, in a very noticeable degree, similarity with those of the Ludlowville and Skaneateles shales but toward the upper part of the formation which is not here completely represented, noteworthy diversities are observable. The student of these fossils will do well to compare them first with care with the species from the formations cited which have been described in detail in the volumes of the *Palaeontology of New York* and then by reference to lists of Ithaca fossils which have been published on different occasions to determine the degree of variation presented by the fossils from the predecessors in the earlier faunas. One may expect to find brachiopods and lamellibranchs specially abundant and more occasionally gastropods, corals and some crinoids. The species obtainable from these rocks are indicated in lists given in reports of the state geologist for 1894 and 1895, and specially in that subjoined in the paper immediately following this.

ITHACA FAUNA OF CENTRAL NEW YORK

BY JOHN M. CLARKE

In connection with the studies recently made and published of the western New York fauna of Portage time and with the publication of the Tully, Watkins and Elmira maps whereupon the Ithaca formation is extensively represented, a more complete statement than has heretofore been made of the complexion of the true Ithaca fauna becomes of special interest. The relations of this fauna to contemporaneous faunas east and west have been frequently stated by the writer. Briefly recapitulated they are thus:

Portage time and sedimentation in New York involved very marked geographic distinctions; at the east was, during its earliest stage, a marine fauna quickly followed by a lagoon deposition known as the Oneonta sandstone. Continuous with these beds through Chenango, Cortland and Tompkins counties are the true Ithaca beds carrying the littoral marine fauna here set forth; these beds being interleaved with the Oneonta deposits eastward and the true Portage or Naples beds westward. The latter contain an invading and deeper water fauna having nothing in common with that of the Ithaca beds and its composition has been set forth in detail in the *16th Annual Report of the New York State Geologist* and *Museum Memoir 6.*

Till 10 or 12 years ago a singular and deplorable misapprehension of the significance of the Ithaca fauna prevailed and was inadvertently countenanced in some of the volumes of the *Palaeontology of New York.* Its fossils, lying well above the horizon of the Hamilton shales of central New York were in many instances described as of the Hamilton fauna, and it is to the work of Prof. C. S. Prosser that we owe the first rectification of these errors and the return to Vanuxem's original conception of the place of the Ithaca fauna. Subsequently Prof. Prosser and the writer at first together and afterward independently further exploited these rocks, the former more specially east of the Chenango river and the latter westward therefrom. Both have incorporated, in the several descriptive accounts published by them in the reports of the state geologist, lists

of the species found by them at the various horizons in the rocks throughout the regions mentioned, which virtually cover the extent of the formation.

The material on which the identifications here following are based does not include or have reference to that collected either by Professor Prosser or the writer. Some uncertainties having arisen as to the exactitude of identifications and comparisons and also with reference to the precise horizon of some species, collecting operations were begun *de novo* in 1900 in this territory by Mr Luther and the following localities are those from which material was then acquired. The suite of fossils obtained was very extensive and much of it the best in quality that the rocks have afforded.

It has been well recognized and often referred to in the published papers of Professor Prosser and the writer that this fauna is at first a repetitive occurrence of the Hamilton fauna beneath, shades of difference in the species above and below the horizon of the Tully limestone and Genesee shale and Sherburne sandstone being at first absent or obscure, but becoming more pronounced upward in the series and accompanied by the introduction of species alien to the fauna below. Broadly it may be said that the fauna starting at the base of the Ithaca sedimentation is essentially Hamilton but by degrees, by the addition of species and through mutational and profounder variation from the ancestral species, puts on a different aspect and gradually assumes that of the higher or Chemung fauna. The constituents of the fauna as here tabulated have been made up with the greatest care and extraordinary precaution with an eye keen to the detection of departures from the specific types.

We have found thus far no good basis for a division of these sediments either on lithologic or faunal characters, hence, for convenience in indicating the relative position of the species, have indicated an upper and lower division quite perfunctorily, taking as a dividing line the middle of the section in the different meridians. The distinction in elevation is noted in the locality numbers following the species names, the higher horizons being printed in heavier figures. The fauna in point of number is prevailingly affiliated to that of the

Hamilton (Ludlowville and Skaneateles shales) and the names of all species antedating the close of the Tully limestone stage are printed in roman.

LIST OF LOCALITIES OF ITHACA FOSSILS

The numbers are those of the museum locality record.

2446 Ithaca beds. Norwich, Chenango co. Sides of a shallow cut of the Delaware, Lackawanna & Western Railroad ½ mile north of railroad station; nearly the lowest exposure in this vicinity; about 15 feet of shales and soft sandstones poorly exposed. D. D. Luther, collector. 1900.

2447 Ithaca beds. From excavation for cellar, near former blast furnace; 40 rods north of 2446, including the same strata, and a few feet lower; exposure in all about 25 feet. Norwich. D. D. Luther, collector. 1900.

2448 Ithaca beds. "Breed's ravine", 3 miles south of Norwich on west side. Exposure of 15–20 feet near an old mill dam, ½ mile from the valley road. About 200 feet below Oneonta. D. D. Luther, collector. 1900.

2449 Ithaca beds. Three small, old quarries on west side of the valley road 2 miles south of Norwich. (Clarke's A) Horizon near middle of the fossiliferous Ithaca. D. D. Luther, collector. 1900.

2450 Ithaca beds. Old quarry on hillside, west of cemetery 1 mile south of Norwich; about 150 feet above railroad and 25–50 feet higher than 2449. Not many fossils except in calcareous lens 6 inches thick, 20 feet long, that contains many large specimens of Grammysia. D. D. Luther, collector. 1900.

2451 Ithaca beds. Along the bed of Canasawacta creek in the village of Norwich; about same horizon as 2446 and 2447; 10 feet of shales and thin sandstones exposed. D. D. Luther, collector. 1900.

2452 Ithaca beds. Old quarry by side of road leading up the hill west of Norwich, above where Preston road turns northward. 250 feet or more above creek bed. D. D. Luther, collector. 1900.

2453 Ithaca beds. Dump from a well, above the corner of the Preston road; west of Norwich. D. D. Luther, collector. 1900.

2454 Ithaca beds. Vicinity of Brookin's quarry, on Preston road, 1 mile northwest of Norwich. About same horizon as 2450. D. D. Luther, collector. 1900.

2455 Ithaca beds. Small ravine near Henry Brown's, 1¼ miles southeast of Norwich. Horizon a little lower than 2450. D. D. Luther, collector. 1900.

2456 Ithaca beds. Old Wilkes's or Benedict quarry, 4 miles north of Norwich (2 miles southwest of North Norwich) on hillside, west side of valley. 250 feet or more higher than railroad and somewhat above the lower exposures at Norwich. D. D. Luther, collector. 1900.

2457 Ithaca beds. Small quarry on Snow creek on east side of valley, 2 miles southeast of Norwich. Horizon about middle (or little higher) of the Ithaca. D. D. Luther, collector. 1900.

2458 Ithaca beds. Along Ransford creek, in the vicinity of Bennett's quarry (formerly Mead's), and includes exposure in creek bed; about same horizon as 2446, 2447 and 2451, making with the quarry 50 feet. The exposure is directly east of Norwich, east of the river; and there is a fair section exposed along the creek to the waterworks reservoir, making 100 feet or more. D. D. Luther, collector. 1900.

2460 Ithaca beds. 1 mile east of Norwich, on Ransford creek near Bennett's quarry (formerly Mead's). D. D. Luther, collector. 1900.

2461 Ithaca beds. Rock cut near the reservoir on Ransford creek, 1½ miles east of Norwich, 150–75 feet higher than the railroad. D. D. Luther, collector. 1900.

2462 Ithaca beds. Old quarry at top of hill, above Wilkes's quarry; 2 miles west of Smyrna. D. D. Luther, collector. 1900.

2463 Ithaca beds. Among shaly sandstones that look like Sherburne. Bottom of small valley ½ mile west of Upperville, Chenango co. D. D. Luther, collector. 1900.

2465 Ithaca beds. By roadside 250 feet above Wilkes's quarry, Smyrna. Taken out of gutter. Top of Sherburne ? D. D. Luther, collector. 1900.

2466 Ithaca beds. Old quarry on west side of Canasawacta creek, 2½ miles northwest of Norwich. D. D. Luther, collector. 1900.

2467 Ithaca beds. Crandall quarry on side hill, south of Preston road, 1½ miles northwest of Norwich. Top of fossiliferous Ithaca. D. D. Luther, collector, 1900.

2468 Ithaca beds. Brookin's quarry on Preston road, 1 mile northwest of Norwich. D. D. Luther, collector. 1900.

2469 Ithaca beds. Bed of Canasawacta creek in western part of Norwich. D. D. Luther, collector. 1900.

2470 Ithaca beds. Old quarries by roadside 2 miles south of Norwich, on west side of Oxford road. D. D. Luther, collector. 1900.

2471 Ithaca beds. Ledge on side hill, 1 mile west of Noblesville, Otsego co.; on west side 150 feet above valley. D. D. Luther, collector. 1900.

2472 Ithaca beds. Small outcrop on hillside west of Noblesville, 75 feet above bottom of valley. D. D. Luther, collector. 1900.

2473 Ithaca beds. Ravine east of South Otselic, Chenango co. About 200 feet above bottom of section. D. D. Luther, collector. 1900.

2474 Ithaca beds. Ravine east of South Otselic; from base of exposed section. D. D. Luther, collector. 1900.

2475 Ithaca beds. Ravine east of South Otselic 100 feet above bottom of section. D. D. Luther, collector. 1900.

2476 Ithaca beds. The Pitcher mineral springs ravine, 1½ miles north of Pitcher, Chenango co. D. D. Luther, collector. 1900.

2477 Ithaca beds. Madison's gulf, 1 mile north of hotel, South Otselic. Horizon=upper part of Sherburne (?) D. D. Luther, collector. 1900.

2478 Ithaca beds. Pharsalia Hook, Chenango co. Small ravine west of the village. D. D. Luther, collector. 1900.

2479 Ithaca beds. Hake's ravine, 1 mile north of Pitcher. D. D. Luther, collector. 1900.

2480 Ithaca beds. Burdick settlement; ravine 1 mile southeast by road to South Otselic. D. D. Luther, collector. 1900.

2481 Ithaca beds. Ravine from Pitcher mineral springs 1½ miles north of Pitcher, on east side of valley. D. D. Luther, collector. 1900.

2482 Ithaca beds. Outcrop on hillside 1 mile west of Noblesville (New Lisbon). In Sherburne. D. D. Luther, collector. 1900.

2483 Ithaca beds. From loose block by side of road, 2 miles west of Morris, Otsego co. D. D. Luther, collector. 1900.

2484 Ithaca beds. Ravine 1½ miles southwest of Morris; west side of valley. D. D. Luther, collector. 1900.

2485 Ithaca beds. St Mary's falls, 3 miles southwest from Morris. D. D. Luther, collector. 1900.

2486 Ithaca beds. Loose in highway, 1 mile south of Noblesville. D. D. Luther, collector. 1900.

2487 Ithaca beds. Small ravine ¼ mile east of Noblesville. The layer is 50–75 feet higher than the road. D. D. Luther, collector. 1900.

2488 Ithaca beds. Outcrop in highway 3 miles west of Morris, on the road to New Berlin. D. D. Luther, collector. 1900.

2489 Ithaca beds. Small ravine on east side of valley, 1½ miles southeast of Morris. D. D. Luther, collector. 1900.

2490 Ithaca beds. Small ravine coming down from the south on the hill ½ mile northeast of Noblesville. Near the base of Sherburne. D. D. Luther, collector. 1900.

2491 Ithaca beds. McNetts gulf, Morris. D. D. Luther, collector. 1900.

2492 Ithaca beds. Ravine 1 mile northeast of Morris. D. D. Luther, collector. 1900.

2493 Ithaca beds. Field outcrop on hillside 80 rods southeast from hotel in South Otselic, and about 250 feet above bottom of valley. D. D. Luther, collector. 1900.

2494 Ithaca. Sherburne sandstone. Ravine 1 mile east of Nobles-ville. D. D. Luther, collector. 1900.

2495 Ithaca. Sherburne sandstone. Laurens, Otsego co.; small ravine in west part of village. D. D. Luther, collector. 1900.

2496 Ithaca beds. Messengerville, Cortland co.; along railroad north of depot. D. D. Luther, collector. 1900.

2497 Ithaca beds. Ravine east of Marathon, Cortland co. R. Ruedemann, collector. 1900.

2498 Ithaca beds. Along creek running into the Otselic, ½ mile west of Cincinnatus, Cortland co. R. Ruedemann, collector. 1900.

2499 Ithaca beds. Marathon; reservoir. R. Ruedemann, collector. 1900.

2500 Ithaca beds. Outcrop along first southerly brook running into Trout creek; Cincinnatus. R. Ruedemann, collector. 1900.

2501 Ithaca beds. Outcrop along creek running along Cortland road, ½ mile west of Cincinnatus. R. Ruedemann, collector. 1900.

2502 Ithaca beds. Messengerville. Exposure on south branch of Virgil creek, 100 feet above station. D. D. Luther, collector. 1900.

2503 Ithaca beds. Messengerville. Exposure near mouth of Virgil creek. D. D. Luther, collector. 1900.

2504 Ithaca beds. McGrawville, Cortland co. Pritchard's ravine, 1 mile east of the village. From the sandstone in the middle of the section. D. D. Luther, collector. 1900.

2505 Ithaca beds. McGrawville. Pritchard's ravine, 1 mile east of the village. From the upper section of the gully, 150 feet above lowest exposure. D. D. Luther, collector. 1900.

2506 Ithaca beds. McGrawville. Pritchard's ravine, 1 mile east of village. From lower part of section. D. D. Luther, collector. 1900.

2507 Ithaca beds. Cincinnatus. A small outcrop 1½ miles southwest of village, by side of railroad; 80 feet above river. Fossils of any kind very rare. D. D. Luther, collector. 1900.

2508 Ithaca beds. Marathon; railroad cut near station. R. Ruedemann, collector. 1900.

2509 Ithaca beds. South New Berlin, Chenango co.; ravine east of village. Horizon, middle and lower Ithaca. Specimens from upper part of section. D. D. Luther, collector. 1900.

2510 Ithaca beds. Ravine west of White Store, Chenango co., 4 miles south of South New Berlin. Lowest exposure (lower part of upper Ithaca). D. D. Luther, collector. 1900.

2511 Ithaca beds. Buttermilk falls ravine near Phelps crossing, 3 miles north of South New Berlin. Base of Ithaca at top of lower falls. D. D. Luther, collector. 1900.

2512 Ithaca beds. South New Berlin. Same as 2511. D. D. Luther, collector. 1900.

2513 Ithaca beds. Killawog creek west of Killawog, Broome co. D. D. Luther and R. Ruedemann, collectors. 1900.

2514 Ithaca beds. Pierce's ravine, 2½ miles west of Lisle, Broome co. D. D. Luther and R. Ruedemann, collectors. 1900.

2515 Ithaca beds. Small quarry 1 mile west of Lisle, on west side of valley. D. D. Luther and R. Ruedemann, collectors. 1900.

2516 Ithaca beds. Howlands glen, a ravine 1 mile west of Lisle station opening into valley of Dudley creek. D. D. Luther, collector. 1900.

2517 Ithaca beds. Killawog; ravine east of village. R. Ruedemann, collector. 1900.

2518 Ithaca beds. Harrison's gulf, Smithville Flats, Chenango co.; on west side, 1 mile north. D. D. Luther, collector. 1900.

2519 Ithaca beds. Whitney's Point, Broome co.; Sullivan's quarry, 1 mile west. 200 feet above river. D. D. Luther, collector. 1900.

2520 Ithaca beds. Lisle; 1 mile north of station, along east side of river. D. D. Luther and R. Ruedemann, collectors. 1900.

2523 Ithaca beds. Roadside north of Emmons, Otsego co., 3 miles east of Oneonta. 100 feet below top of Ithaca. D. D. Luther, collector. 1900.

2524 Ithaca beds. Highest beds of formation, Ean's quarry 1 mile east of Oneonta. D. D. Luther, collector. 1900.

2525 Ithaca beds. Upper layers. Quarry on hillside north of Emmons. D. D. Luther, collector. 1900.

2526 Ithaca beds; upper layers. Quarry on hillside north of Emmons. D. D. Luther, collector. 1900.

2527 Ithaca beds. Cowles hill, Greene, Chenango co. D. D. Luther, collector. 1900.

2528 Ithaca beds. West, or Willard's, hill, ¼ mile west of Greene, and ¼ mile north of Cowles hill. D. D. Luther, collector. 1900.

2530 Ithaca beds. Juliand hill, Greene. D. D. Luther, collector. 1900.

Crustaceans

Phacops rana *Green,* 2449, 2455, 2460, **2461,** 2475, 2489, 2492, 2511, 2512
Cryphaeus boothi *Green,* 2484
Homalonotus dekayi *Green,* 2449
Echinocaris punctata *Hall,* 2451, 2480, 2494, 2495
Rhinocaris columbina *Clarke,* 2471, 2474, 2479, 2494, 2495, 2507
R. capsella *Clarke,* 2478, 2479
R. scaphoptera *Clarke,* 2451, 2511
R. ?, 2500

Cephalopods

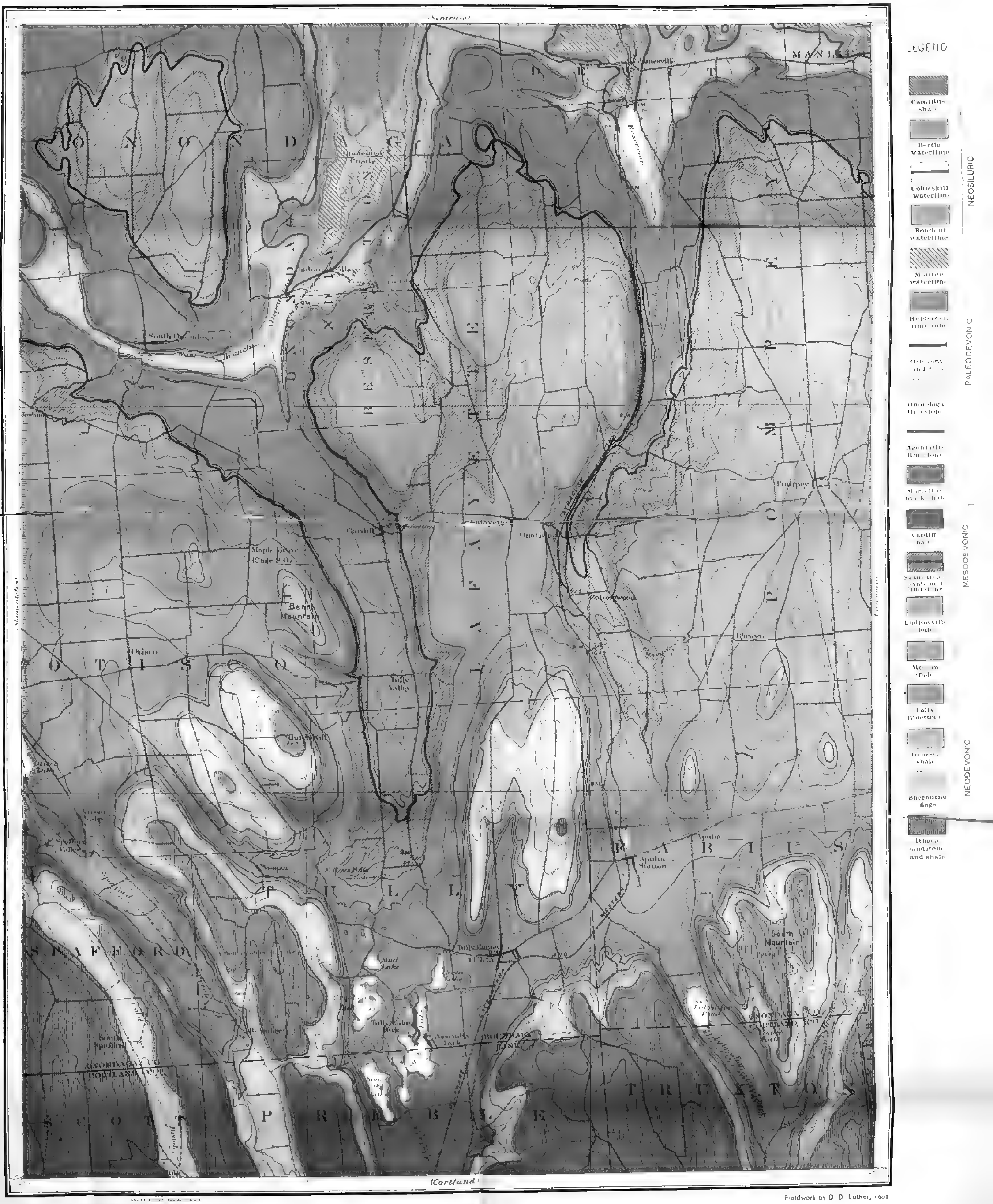
Orthoceras nuntium *Hall,* 2473, 2511
O. pacator Hall ?, 2494
O. bebryx var. cayuga Hall, 2484
O. *cf.* bebryx *Hall,* 2527
O. *sp. incert.* 2461, 2479, 2481, 2482, 2488, **2497, 2501, 2502, 2509, 2513, 2516**
Bactrites sp. nov. 2478, **2516**
Tornoceras uniangulare *Conrad,* 2472, 2477, **2478,** 2482, 2487, 2490, 2494

Pteropods

Tentaculites bellulus *Hall,* 2500, **2526**
T. cf. spiculus Hall, 2460, 2473, 2478, **2497, 2502, 2520**
T. *sp. incert.* 2449, 2466, 2468, 2478, **2496, 2497, 2499, 2502, 2508**
T. *nov.* 2478
Styliolina fissurella *Hall,* 2464
Conularia congregata Hall ?, 2479
C. *cf.* crebristriata *Hall,* 2474
C. *sp.*?, 2495

Brachiopods

Bryozoans



Fieldwork by D. D. Luther, 1902

Scale 1/62500

Contour interval 20 feet

Datum is mean sea level

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The superior figures tell the exact place on the page in ninths; e. g. 260^8 means page 260 beginning in the third ninth of the page, i. e. about one third of the way down.

New York State Education Department

New York State Museum

PUBLICATIONS

Postage or express to places outside of New York State must be paid in addition to the price given. On 10 or more copies of any one publication 20% discount will be given, the buyer to pay transportation. Editions printed are only large enough to meet special claims and probable sales. When the sale copies are exhausted, the price for the few reserve copies is advanced to that charged by secondhand booksellers, in order to limit their distribution to cases of special need. Such prices are inclosed in [ ]. All publications are in paper covers, unless binding is specified.

Museum annual reports 1847-date. ***All in print to 1892, 50c a volume, 75c in cloth; 1892-date, 75c, cloth.***

These reports are made up of the reports of the director, geologist, paleontologist, botanist and entomologist, and museum bulletins and memoirs, issued as advance sections of the reports.

Geologist's annual reports 1881-date. Rep'ts 1, 3-13, 17-date, O; 2, 14-16, Q.

The annual reports of the early natural history survey, 1837-41, are out of print.

Reports 1-4, 1881-84, were published only in separate form. Of the 5th report 4 pages were reprinted in the 39th museum report, and a supplement to the 6th report was included in the 40th museum report. The 7th and subsequent reports are included in the 41st and following museum reports, except that certain lithographic plates in the 11th report (1891) and 13th (1893) are omitted from the 45th and 47th museum reports.

Separate volumes of the following only are available.

Report	*Price*	*Report*	*Price*	*Report*	*Price*
12 (1892)	$.50	17	$.75	21	$.40
14	.75	18	.75	22	.40
15, 2v.	2	19	.40	23	*In press*
16	1	20	.50		

In 1898 the paleontologic work of the State was made distinct from the geologic and will hereafter be reported separately. The two departments were reunited in 1904.

Paleontologist's annual reports 1899-1903.

See fourth note under Geologist's annual reports.

Bound also with museum reports of which they form a part. Reports for 1899 and 1900 may be had for 20c each. Those for 1901-3 were issued as bulletins. In 1904 combined with geologist's report.

Entomologist's annual reports on the injurious and other insects of the State of New York 1882-date.

Reports 3-19 bound also with museum reports 40-46, 48-57 of which they form a part. Since 1898 these reports have been issued as bulletins. Reports 3-4 are out of print, other reports with prices are:

Report	*Price*	*Report*	*Price*	*Report*	*Price*
1	$.50	9	$.25	15 (En. 9)	$.15
2	.30	10	.35	16 (" 10)	.25
5	.25	11	.25	17 (" 14)	.30
6	.15	12	.25	18 (" 17)	.20
7	.20	13	.10	19 (" 21)	.15
8	.25	14 (En 5)	.20	20 *In press*	

Reports 2, 8-12 may also be obtained bound separately in cloth at 25c in addition to the price given above.

Botanist's annual reports 1867-date.

Bound also with museum reports 21-date of which they form a part; the first botanist's report appeared in the 21st museum report and is numbered 21. Reports 21-24, 29, 31-41 were not published separately.

Separate reports 25-28, 30, 42-50 and 52 (Botany bulletin 3), are out of print. Report 51 may be had for 40c; 53 for 20c; 54 for 50c. Since the 55th these reports have been issued as bulletins.

Descriptions and illustrations of edible, poisonous and unwholesome fungi of New York have been published in volumes 1 and 3 of the 48th museum report and in volume 1 of the 49th, 51st, 52d, 54th and 55th reports. The descriptions and illustrations of edible and unwholesome species contained in the 49th, 51st and 52d reports have been revised and rearranged, and, combined with others more recently prepared, constitute Museum memoir 4.

Museum bulletins 1887-date. O. *To advance subscribers, $2 a year or 50c a year for those of any one division:* (1) *geology, economic geology, mineralogy,* (2) *general zoology, archeology and miscellaneous,* (3) *paleontology,* (4) *botany,* (5) *entomology.*

Bulletins are also found with the annual reports of the museum as follows:

Bulletin	*Report*	*Bulletin*	*Report*	*Bulletin*	*Report*	*Bulletin*	*Report*
G 1	48, v.1	Pa 1	54, v.1	En 7–9	53, v.1	Ar 3	52, v.1
2	51, v.1	2, 3	" v.3	10	54, v.2	4	54, v.1
3	52, v.1	4	" v.4	11	" v.3	5	" v.3
4	54, v.4	5, 6	55, v.1	12, 13	" v.4	6	53, v.1
5	56, v.1	7–9	56, v.2	14	55, v.1	7	56, v.4
Eg 5, 6	48, v.1	Z 3	53, v.1	15–18	56, v.3	Ms 1, 2	" v.4
7	50, v.1	4	54, v.1	Bo 3	52, v.1		
8	53, v.1	5–7	" v.3	4	53, v.1	Memoir	
9	54, v.2	8	55, v.1	5	55, v.1	2	49, v.3
10	" v.3	9	56, v.3	6	56, v.4	3, 4	53, v.2
11	56, v.1	En 3	48, v.1	Ar 1	50, v.1		
M 2	" v.1	4–6	52, v.1	2	51, v.1		

The figures in parenthesis indicate the bulletin's number as a New York State Museum bulletin.

Geology. G1 (14) Kemp, J. F. Geology of Moriah and Westport Townships, Essex Co. N. Y., with notes on the iron mines. 38p. 7pl. 2 maps. Sep. 1895. *10c.*

G2 (19) Merrill, F: J. H. Guide to the Study of the Geological Collections of the New York State Museum. 162p. 11 9pl. map. Nov. 1898. [*50c*]

G3 (21) Kemp, J. F. Geology of the Lake Placid Region. 24p. 1pl. map. Sep. 1898. *5c.*

G4 (48) Woodworth, J. B. Pleistocene Geology of Nassau County and Borough of Queens. 58p. il. 9pl. map. Dec. 1901. *25c.*

G5 (56) Merrill, F: J. H. Description of the State Geologic Map of 1901. 42p. 2 maps, tab. Oct. 1902. *10c.*

G6 (77) Cushing, H. P. Geology of the Vicinity of Little Falls, Herkimer Co. 98p. il. 15pl. 2 maps. Jan. 1905. *30c.*

Woodworth, J. B. Pleistocene Geology of the Mooers Quadrangle. *In press.*

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Cushing, H. P. Geology of the Northeast Adirondack Region. *In press.*

Ogilvie, I. H. Geology of the Paradox Lake Quadrangle. *In press.*

Kemp, J. F. Crystalline Rocks of Warren and Washington Counties. *In preparation.*

Economic geology. Eg1 (3) Smock, J: C. Building Stone in the State of New York. 152p. Mar. 1888. *Out of print.*

Eg2 (7) ——— First Report on the Iron Mines and Iron Ore Districts in the State of New York. 6+70p. map. June 1889. *Out of print.*

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Geologic map of the Tully quadrangle

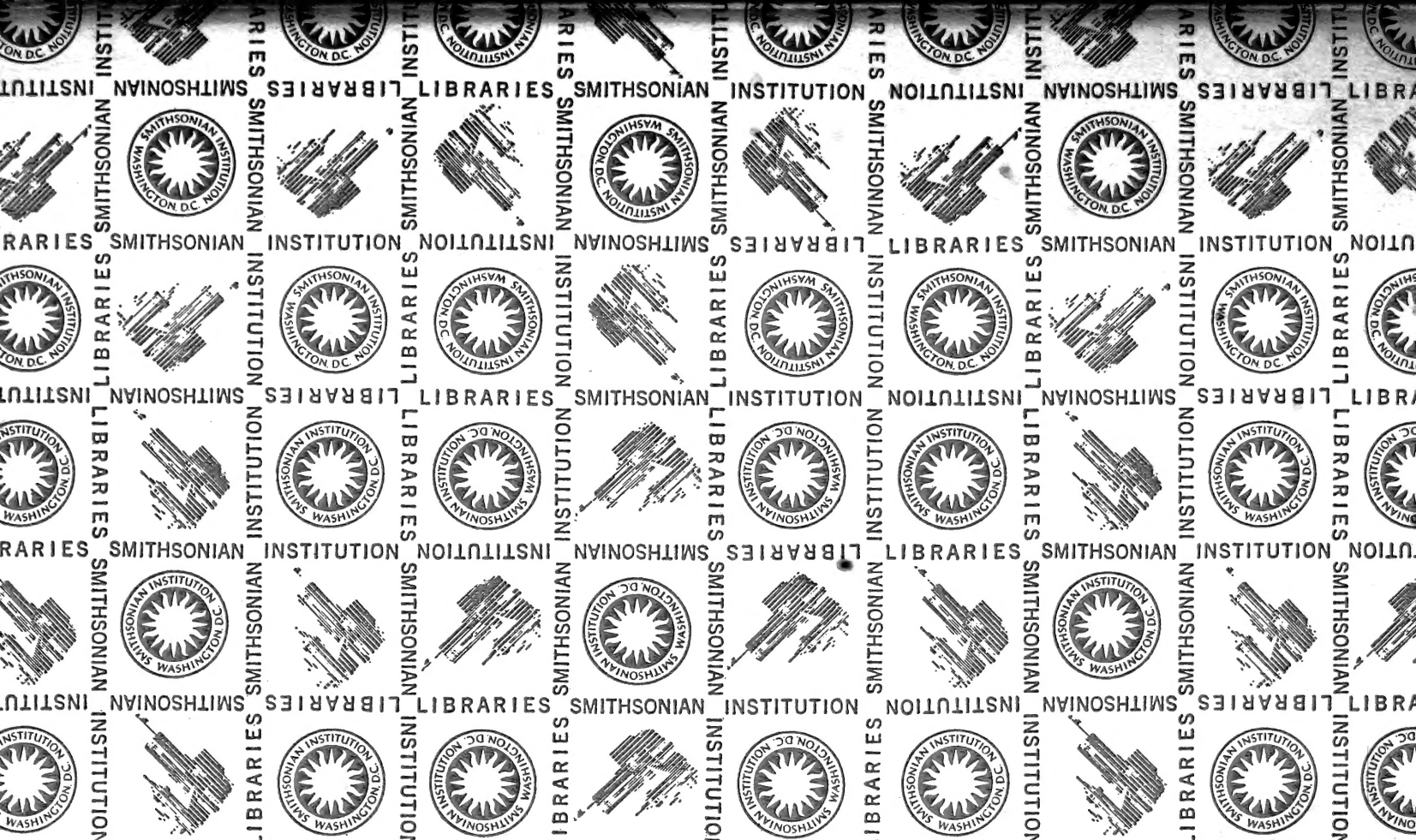
New York State Museum

The New York State Museum as at present organized is the outgrowth of the Natural History Survey of the State commenced in 1836. This was established at the expressed wish of the people to have some definite and positive knowledge of the mineral resources and of the vegetable and animal forms of the State. This wish was stated in memorials presented to the Legislature in 1834 by the Albany Institute and in 1835 by the American Institute of New York city and as a result of these and other influences the Legislature of 1835 passed a resolution requesting the secretary of state to report to that body a plan for "a complete geological survey of the State, which shall furnish a scientific and perfect account of its rocks, soils and materials and of their localities; a list of its mineralogical, botanical and zoological productions and provide for procuring and preserving specimens of the same; etc."

Pursuant to this request, Hon. John A. Dix, then secretary of state, presented to the Legislature of 1836 a report proposing a plan for a complete geologic, botanic and zoologic survey of the State. This report was adopted by the Legislature then in session and the governor was authorized to employ competent persons to carry out the plan which was at once put into effect.

The scientific staff of the Natural History Survey of 1836 consisted of John Torrey, botanist; James E. DeKay, zoologist; Lewis C. Beck, mineralogist; W. W. Mather, Ebenezer Emmons, Lardner Vanuxem and Timothy A. Conrad, geologists. In 1837 Professor Conrad was made paleontologist and James Hall, who had been an assistant to Professor Emmons, was appointed geologist to succeed Professor Vanuxem, who took Professor Conrad's place.

The heads of the several departments reported annually to the governor the results of their investigations, and these constituted the annual octavo reports which were published from 1837 to 1841. The final reports were published in quarto form, beginning at the close of the field work in 1841, and 3000 sets have been distributed, comprising four volumes of geology, one of mineralogy, two of botany, five of zoology, five of agriculture, and eight of paleontology.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